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MECHANICS' AND INVENTORS' JOURNAL

VOL. II., NO. 9. NEW YORK, MAY 1, 1879. PRICE, $1 PER ANNUM.

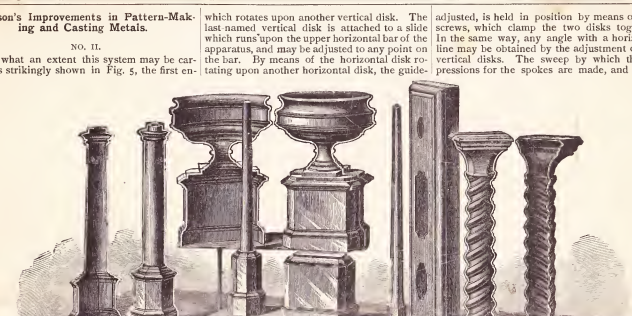
Jackson's Improvements in Pattern-Making and Casting Metals.

NO. II.

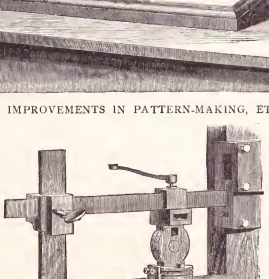
To what an extent this system may be carried is strikingly shown in Fig. 5, the first engraving on this page, which represents a group of patterns made in the general manner described, including even spiral forms. Extreme accuracy, great rapidity, and consequent saving of skilled labor are secured. Among other experiments we witnessed the operation of pattern-making for a five-pail kettle, of the usual round-bottom kind. It was made, if our memory does not betray us, in somewhat less than five hours. The pattern could have easily been dried and the casting made in the same day. But the system is also readily applied to the manufacture of castings for mill gearing and toothed wheels of all sorts, even bevel gearing being made by it. We illustrate the operation of pattern-making for gear wheels in Figs. 6 and 7. Pulleys or gear wheels having either straight or curved spokes are produced with surprising facility.

Figure 6 represents the apparatus employed for forming the bed of a pattern for a spur wheel. The plastic material having been placed upon the face-plate, the sweep shown at the left of the engraving is adjusted. The rotation of the face-plate then sweeps the top of the bed, also the recess in the centre for the hub, a ledge or shoulder at the outer edge being left for the support of the rim. The depressions in which the spokes of the pattern are to rest are then formed with the sweep shown at the right of the engraving. This sweep is attached to a guide-bar, which is attached to a horizontal disk that rotates upon another horizontal disk, the upper horizontal disk being attached to a vertical disk which rotates upon another vertical disk. The last-named vertical disk is attached to a slide which runs upon the upper horizontal bar of the apparatus, and may be adjusted to any point on the bar. By means of the horizontal disk rotating upon another horizontal disk, the guide-bar may be adjusted to any angle with the centre of the wheel to be formed, and, when so adjusted, is held in position by means of set-screws, which clamp the two disks together. In the same way, any angle with a horizontal line may be obtained by the adjustment of the vertical disks. The sweep by which the depressions for the spokes are made, and which is attached to the slide on the guide-bar at the right of the engraving, is cut to the form of the section of the smallest part of the spoke, but it is made somewhat longer vertically than is necessary to describe this section. The guide-bar is then set at an angle with the centre corresponding to the horizontal taper it is required to give the spoke, and by means of the two upper disks it is also set to the vertical angle corresponding to the vertical taper required. The sweep is then made from the small outer end of the spoke to the large end, and by means of the division-plate the spacing of the spokes is exactly performed. The angles for the vertical and horizontal taper of the spokes are easily obtained. The edges of the disks by which the adjustment of the guide-bar is made are graduated or divided into degrees. They are also provided with stops, which are set to correspond with the degree limiting the angle, and thus make the taper of each spoke exactly uniform on both sides. The machine having been thus adjusted for the production of the bed, and the bed having been formed as described, no change in adjustment is required, in commencing the pattern, except the removal of the sweeps, and replacing them by others suitable for sweeping the pattern. After varnishing the bed, the plastic material is then built upon it, building it out over the shoulder in the bed to a sufficient distance to allow the forming of the teeth of the wheel. The bed itself forms the under sides of the

(*Continued on page 100.*)



JACKSON'S IMPROVEMENTS IN PATTERN-MAKING, ETC. FIG. 5.



JACKSON'S IMPROVEMENTS IN PATTERN MAKING, ETC. FIG. 6.

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SALEM H. WALES. EDWARD H. WALES.

CONTENTS, May 1, 1879.

CALLING the attention of our readers to the advertisement of our Patent Department, which appears among other advertising in the present number, we desire to say that we shall be happy to correspond or to consult with inventors or others interested in new inventions relative to any matter connected with the procuring of patents, the validity of patents already obtained, reissues, interferences, trade-marks, caveats, etc., and to make preliminary examinations when desired. All communications and consultations are held to be strictly confidential.

IN our last number we commenced the publication of a column of advertising under the title of "Business Hints." It is intended for the accommodation of advertisements of a brief character (which would not be conspicuous if distributed among larger advertisements), for business cards, short announcements, etc. Advertisers occupying larger space in our general advertising columns will find it to their interest also to insert their business cards under this heading.

The Edison Electric Light.

"INSIDE of two months, if nothing interferes, he will be able to make the whole thing public." This is the assertion of a New York *Sun* interviewer, who since our last issue has visited the great inventor.

When we say "great inventor" we mean all that the words imply, and we should say it all the same if the much (we fear *too* much) promised electric light should be, as has been affirmed in some quarters, a failure. Nay, we should hardly hesitate to rank Mr. Edison (at least among contemporary inventors) as *greatest*. We do not believe any other inventor of the present generation has evinced so much versatility and originality, and were he now to prematurely terminate his career, his name would be sure to descend to posterity enrolled among those of the mightiest geniuses whose intellects have unveiled the mysteries of nature.

Having paid this sincere tribute of admiration to the brilliant genius of Mr. Edison, we are just as free to express the opinion that the interviews he permits to reporters of the daily press, more particularly the New York *Sun*, will not fail to place him in a false position before the scientific world. Profuse promises do not, even in the event of the most brilliant success, increase the merit or enhance the credit awarded to it. And if, as may chance to the greatest of geniuses, failure be sometimes encountered, it is made conspicuous, in proportion to the exaggerated expectations raised by such promises.

The interview purports to have been sought with reference to an article published in the *London Times*, which declared that Mr. Edison had failed in his attempt to produce an electric light. One of its averments strikingly illustrates the imprudence of intrusting to the average news reporter statements involving technical and scientific facts, necessarily more or less couched in technical or scientific terms, a language which is in general very imperfectly understood by gatherers of news items for the daily press.

The *Times'* article referred to says: "The most that he (Edison) has ever yet accomplished has been to maintain 400 coiled iron wires in a state of partial incandescence with a sixteen-horse-power steam-engine. The object of this experiment was to ascertain the number of coils which could be brought to a red heat in any given circuit. It is upon this experiment that Mr. Edison based his claim that he could maintain 20,000 lights burning from one electrical station with a 600-borse-power engine."

Mr. Edison, in his interview with the *Sun* reporter, denies emphatically that he ever made any such extravagant statement as is contained in the last sentence of the paragraph quoted. Yet we feel quite certain that it was somewhere published at least in substance, as part of a conversation in an alleged interview with Mr. Edison. If the assertion denied has gained currency abroad as coming from Mr. Edison, he has only to blame the imprudence he either willingly committed, or was urged to commit by eager backers in making advance statements regarding his light for publication in the daily newspapers.

We are of those who believe Mr. Edison will sooner or later succeed in carrying the electric light to a degree of perfection it never before reached, but he can no more do impossibilities than men of lesser genius, and we do not believe he makes the astounding assertions attributed to him.

For instance, in Mr. Edison's remarks upon the *Times'* article, he is reported in the *Sun* to say that his device for regulating the current to prevent the incandescent wire from melting (which device substantially consists in a bar of metal forming part of the circuit, and which, when the current is too strong, expands and switches off a part of the current, and which was asserted by the *Times* to have failed in practice) is "one of two hundred methods;" leaving it fairly inferrible, in connection with other remarks, that it is one of two hundred methods of regulating the strength of the current invented by him. We do not believe Mr. Edison means to publicly assert any thing like this. There is a tone of extravagant puffing about these reports, which we are very reluctant to think Mr. Edison imparts to his statements in conversations with his interviewers.

However, there are some promises made on this occasion as coming from Mr. Edison which we hope may be fulfilled. It is asserted that, so far from being discouraged by failures as reported in the *Times*, a degree of success highly encouraging has been reached. Nine applications for United States patents have been allowed; none have yet been rejected; eight await examination. The quality of the light is asserted to be good by Mr. Edison and those who have seen it, and is admitted by even the adverse critic of the *London Times* to be "beautiful as the light of a morning-star, pure, brilliant, and mellow."

Mr. Edison promises, if we may credit the *Sun's* report, ere-long to keep five hundred lights at Menlo Park going night and day till the stockholders are fully satisfied. But we are forced to take this report with many grains of allowance, as there are some inconsistencies contained in it which are on their face not the blunders of Mr. Edison. For instance, "We are safe on our lamps" he is made to say. "The one we propose to use will not melt until it gives out a light equal to three gas-jets. We shall not force more than one gas-jet from each lamp," etc. Here it is plainly implied that when the lamps are forced to three gas-jets there is danger of melting the lamp. But a little further along. It is asserted that a light equal to three gas-jets "fairly warms them (the lamps), and that is all. There is scarcely any perceptible heat." In another part of the interview Mr. Edison is represented as saying, "With the regulator I use, it would be contrary to the laws of nature to melt it."

If Mr. Edison permits himself to be paraded before the scientific world after this sort, he must expect to be personally misunderstood, especially abroad, where the true inwardness of interviewing as practised in American journalism is little known. We believe that public faith in his electric light has been far more shaken than strengthened by the alleged interviews relating to the invention published from time to time in the *Sun* and other daily papers.

Mechanical Power.

No words are more frequently used in mechanical engineering than the terms "power" and "work." Yet each has different meanings as used in mechanics, and the ambiguity frequently leads to error in thought upon mechanical subjects. We have at sundry times and in divers places urged the adoption of separate terms to express the different ideas the word power is used to express; but any change in the terminology of an art or science is very difficult to establish. Words adopted to express erroneous and obsolete notions, however unfit to express more modern and accurate ideas, are still retained for that purpose. We deprecate this kind of conservatism, but not being autocrat in science must perforce submit, till the awkwardness of misapplied terms and the mental confusion to which they tend compels their gradual abandonment.

Meanwhile it is important not to be misled by ambiguity so far as to imbibe and retain false notions.

A common error, begotten of the ambiguous sense in which the word power is used, is tbat there may be a gain in mechanical power through the use of levers, tackle, wedges, screws, etc. Even in some of the text-books this idea creeps in. We have in mind a rule taught by one of these books, relating to the lever: "To find the power necessary to raise a given weight, multiply the weight expressed in pounds by the length of the short arm expressed in feet or inches; divide the product by the length of the long arm expressed in the same denomination, and the quotient will be the required power in pounds." A remark is appended to this rule, in substance that the power is therefore to the weight inversely as the long arm is to the short arm, or directly as the short arm is to the long arm. The word power is here used in a specific sense; but being thus used without qualification it is often and easily confounded with the idea expressed by the same word used in a general sense, and which sense its value is not estimated in pounds merely, but in terms of work performed in a given time; that is to say, in pounds raised througb distance against the constant force of gravity in a stated time. The conventional unit of distance in this country and in England is one foot, and the unit of weight one pound —the work represented in the raising of one pound one foot being the unit of work or foot-pound. Now, it is in units of work with reference to time that power in the general sense is estimated, 33,000 of such units accomplished in one minute being by general consent reckoned a horse-power.

The term power as used in the above rule is specific in its meaning. It applies only to static force or resistance, it has no reference to time or distance in and through which the resistance is to be overcome, but refers purely to forces in equilibrio.

These distinctions are not so obvious to ordinary minds that they can be readily retained and remembered on all occasions when the term power has to be comprehended. They are subtle distinctions, requiring good mental training and familiarity with the subject to avoid confusion in regard to them.

The term is still further loaded by being made to do duty as a class name for the material elements of machinery, the lever, pulley, inclined plane, wedge, screw. These are called mechanical powers—very unnecessarily, we think. If a name applicable to all as a class be needed, the term "elements of macbines" is a good one, and we are glad to say it has been substituted for the term objected to in some of the more modern treatises on physics and mechanical construction.

Those well versed in the terminology of mechanical science, and made familiar with all

shades of their meaning by constant use, are very apt to underrate the difficulty among the ordinary run of mechanics in making and clearly retaining the distinctions pointed out in this article. It is not, however, for the learned we write; our aim is to instruct and aid those who have small opportunity to obtain and who make little pretension to learning. The use of ambiguous terms is, however, objectionable, even among the highly cultivated and thoroughly instructed. Eminent writers upon the imperial science of logic have all pointed out the multifarious errors which creep into reasoning through the employment of such terminology.

Recent Improvements in Drying Processes.

THE commercial importance of these improvements is not generally appreciated. It once was thought that any rapid process of desiccation could be practically carried out only by the application of heat. Years ago in a series of articles upon the subject of drying, the writer pointed out that cold could be made an important agent in desiccating delicate food products, as well as all other articles liable to be damaged or discolored by the action of heat.

Air may be made to powerfully attract moisture at a low temperature, if it has by any previous process been made to yield up its moisture. Very few substances are known to possess a stronger attraction for water than air.

Whether the articles alluded to stimulated inquiry and study on the part of investigators, certain it is that the principles therein enunciated and discussed have since that time formed the basis of quite a number of inventions, the object of which is to dry food products without employing much heat. The result is that there has been placed on the general market dried fruits, etc., which retain their color and flavor to a degree that fifteen years since would scarcely have been thought possible.

Improved apparatus for drying by steam heat have also been produced, by which the desiccation of vegetables as well as fruits is greatly accelerated and the quality of the products improved. Desiccated vegetables, especially potatoes, are now regular articles of commerce.

It is, moreover, probable that the raising of sugar beets for the production of sugar will be largely stimulated in this country by these recent improvements in the art of drying, by which the sliced roots may be so quickly, economically, and safely dried that, at small cost, they can be reduced to a proper condition for shipment or for storing indefinitely, while the extraction of the sugar therefrom is facilitated and the yield of sugar is undiminished. Instead of attempting the extraction of sugar from beets on a small sale, which can never prove very profitable, the operation of extraction may proceed in large establishments the year round, and the dried beet slices will become (have, we are informed, already become) a regular article of trade to supply the demands of such large establishments. This latter industry is now only in its infancy, but, if we mistake not, it is destined to have a brilliant future.

A Query about Friction Answered.

WE are asked what would be the relative power consumed in friction with rolling and with sliding stock, special reference being had to the system of sliding-stock for railways to which we devoted a brief article in a recent issue. It will be recollected we stated that a scheme for the construction of such a railway is on foot in the city of Brooklyn, the object being to secure rapid transit on elevated roads without the employment of ordinary locomotives and rolling-stock, and thereby to obviate the nuisances of smoke, dust, and noise as they are met with on our elevated roads in New York.

This estimate of power consumed in friction is based upon the following data supplied by our querist:

Car-wheels for rolling-stock to be 2 feet in diameter. Axle journals, 4 inches in diameter and 6 inches in length.

Runners for sliding-stock to be of oak, 4 inches wide and 24 inches long. Ways for sliding-stock of smooth steel.

Weight of sliding-stock to that of rolling-stock to be as 2 to 3, owing to absence of wheels and trucks in sliding-stock.

We shall assume the journal friction to be that of wrought iron on approved composition or anti-friction bearings, this datum not having been supplied.

Both the journals and the sliding-ways are to be lubricated in the usual way with lard or oil.

We shall take the liberty of assuming the diameter of the axle journals to be 3½ inches, this diameter being more in accordance with approved practice. It will moreover enable us to avail ourselves of tabulated results of experiments on the friction of rolling-stock.

The coefficient of wrought iron upon oak when lubricated is 0.08, and this we shall assume to be the coefficient for steel upon oak, as we find no tabulated coefficient for this in any work of reference immediately at hand; this coefficient cannot be much out of the way.

A loaded car of the ordinary type will weigh on an average 20 tons. The constant force required to keep such a car moving on lubricated oak runners sliding on steel ways will therefore be 40,000 lbs. × 0.08 = 3200.00 lbs.

As the conditions are, hereby, that the weight of sliding-stock shall be to the weight of rolling-stock as to 2 to 3, we must deduct one third from this constant force, which will leave 2133.34 lbs. as the net force required to keep moving a sliding car of the same carrying capacity.

Now by experiment it has been found that it requires 120 lbs. tractive force to keep a rolling car slowly moving on a level track, and the resistance is due partly to the rolling friction of the tread of the wheels upon the top of the rails, and partly to flange friction along the side of the head of the rail as well as to journal friction.

It must not, however, be understood that these figures represent a basis by which the resistance of trains moving at high velocity, say 30 miles per hour, can be estimated. It is found that resistance of trains increases in a considerably larger ratio than the ratio of increase in the velocity.

Thus, a rolling car of 20 tons running at 30 miles per hour will give a resistance of 2250 lbs. The resistance due to journal friction will be but little increased at this speed; the increase in resistance being due largely to air pressure against the head of the train and increase of flange friction through side thrust, and to other causes imperfectly understood.

The resistance due to sliding friction on the runners would, also probably remain nearly a constant for all velocities below 30 miles per hour. The increase of resistance due to air pressure would be about the same for both systems. The element of flange friction would not enter into the system of sliding-stock. If the sliding cars were driven by traction ropes from stationary engines, the resistance due to the locomotive, which with trains of three passenger cars is at least one fourth the entire resistance of the train, would be removed; and for these reasons, and in the absence of actual experiments bearing directly upon the subject, we give it as our opinion that the entire train resistance due to sliding-stock would not be more than double that required for rolling-stock, if indeed it would reach that figure for a train of three cars.

Against the increased power required by increase of train resistance may be offset the saving in running expenses of repairs for locomotives, which is much greater than for stationary engines, economy in wages of engineers and stokers, and increase of power from a given consumption of fuel, owing to the greater effectiveness of stationary boilers and engines. After all these deductions are made, the difference in cost of running in the two systems cannot be so important as might at first be supposed.

Photography in Colors.

MANY people, latterly, have erroneously given to different systems of painting on photograpy the misplaced title "photography in colors." This was too much to say of the ingenious results, some of which were obtained by the transparence of the photographic image, some by other means. Nay, attempts were even made to make us believe that photographic proofs tinted by oil or water-colors were proofs obtained directly in colors. The only process which, up to the present time, has really deserved the name of "photography in colors" is that of M. Ducos du Hauron, but it is only still in infancy, its practice being very difficult, and the colors obtained not always being of the required tone. To arrive at the real colors of nature is no easy task, but we doubt not that M. Ducos du Hauron will, sooner or later, solve this difficult problem.

M. Germeuil Bonnaud's process of photographing in colors—we use this term intentionally, because it is the only term strictly applicable—simply consists in causing the photographic action to operate directly on the color. To this end M. Germeuil Bonnaud has carefully sought the means of rendering a neutral color sensitive, and at the same time insoluble, so that it might be able to resist the numerous baths necessary to the photographic process. When this process is used, all the operations remain the same as in the ordinary method, with this great advantage, that the impressions made by the silver salts on the colored background give precisely the effect of the original model, and have not the hardness of tone that generally characterizes a "retouched" photograph. The print comes out of the bath completely colored. Thanks to the chemical agents and the sensitive paper used by M. Germeuil Bonnaud, the colors and the photograph are henceforward indelibly united. But, in addition to the great artistic results, the material advantages of this discovery are very considerable. Firstly, the true harmony of color is restored, whilst prints colored by any of the old processes—photo painting, as one might call them—are always monotonous, and wanting in durability. By oil painting on the photograph, the employment of water-colors, or even of transparent media, the cost of production was immensely increased. And this was not all, because to obtain really artistic effects it was necessary to employ artists of such a degree of talent as is rarely found in country towns, where one does not find every day a Millais, a Dickinson, or a Nadar. Now the photographer can do it all himself. So much the better for those who are neither painters nor draughtsmen. It appears that the cost of the colored photographs produced by the Germeuil Bonnaud process is very little, if any thing, more than the ordinary uncolored ones. So we get at the price of an ordinary carte-de-visite a photograph in unchangeable and unfading colors.—M. K. VERSNAEYEN, in *Photographic News*.

ARTIFICIAL IVORY.—A patent has been taken out by M. B. Harras, of Böhlen, for the manufacture of artificial ivory by a process of which the following is an outline: The first stage consists in preparing three solutions, one of 100 grammes of size in a litre of water, a second of 50 grammes of alum in a litre of water, and a third of 50 grammes of well-bleached cellulose in 3½ litres of water. The plaster moulds from which it is proposed to obtain the desired casts are then carefully oiled with a mixture of equal parts of goose grease and hog's lard. A mixture is next made, in an earthenware vessel, of 75 parts of the size solution, 200 parts of the cellulose pap, 600 parts of water, 250 parts of well-sifted gypsum, and 200 parts of the alum solution. These must be thoroughly incorporated by diligently stirring. The mixture is then introduced into the moulds, spoonful by spoonful, these being constantly shaken meanwhile, so as to get rid of all air-bubbles that may form. Next a cloth is placed over the mouth of the mould, and all superfluous moisture drained out, after which the cast is left to shrink thoroughly, and is then drenched with a mixture of equal parts of white wax and stearine. When quite cold, the mould is detached bit by bit, either by chipping or brushing, till the shining surface of the cast makes its appearance.

COMPRESSED FLOUR.—It is said that a French chemist some time since conceived the idea of subjecting flour to pressure, for the sake of economy of space in packing. In order to test its effect on the quality of the article, he exposed a quantity of flour to a hydraulic pressure of 300 tons, which reduced the volume to a fourth of its original bulk. On examining the flour thus pressed, he found its quality in no wise impaired. In order to try what effect time would have upon it, he packed both pressed and unpressed in tin boxes, and sealed them up. At the end of three months he examined both sorts and found that the pressed flour had kept better than the unpressed. He had a portion of each sort baked into bread, and the bread made from the pressed flour showed a decided superiority. After the lapse of a year he repeated the experiment, and found that the unpressed flour had turned bad, whilst the pressed flour was fresh and sweet and made excellent bread.

(*Continued from page 97.*)

spokes. The upper sides of the spokes are formed by a sweep which is like the section of the larger part of the spoke. The vertical and horizontal tapers are obtained precisely as in sweeping the recess for the spokes in the bed, only in this case the sweep is made to work from the inner or larger part of the spoke toward the outer and smaller part. The teeth are then formed by first adjusting the guide-bar in a vertical position, and placing upon it a sweep having the proper form to sweep the teeth. These are swept three at a time, as shown in Fig. 7, the division-plate being used to space them accurately, as heretofore described. This is the entire operation necessary to make a pattern in plaster of a spur-wheel and its bed. However, the improvements in pattern-making which we have thus briefly described would not be of so great value were it not also for certain improvements in the art of casting after the patterns are formed, but this part of the subject we reserve for future discussion.

The system of making the lighter sorts of patterns first in plaster and duplicating them in soft metal opens a wide field for the ingenuity of a competent foreman, but the actual work after the sweeps are made requires so little skill, that very cheap help will suffice to perform it.

Cigarette Manufacture in Cuba.*

THE Honradez cigarette factory in Havana, the largest in the world, stands at the corner of two of the narrowest and busiest streets in this busy city. It is built of stone and covered with plaster, like nearly every other building in Havana. The office, like the rest of the building, and, indeed, like most of the city, is grand and not grand, magnificent and squalid, comfortable and uncomfortable. The windows (perhaps windows, but more exactly holes in the wall) have no glass in them, but are guarded by iron bars. The doors are the most imposing parts of this office. Any one of them is large enough to admit four men abreast. None of them are less than 10 feet high (for the ceilings of these buildings are up in the air, often 15 feet or more), and each door is surmounted by a semicircle of colored glass of the most gorgeous hues—bright yellow, and bright red, and bright blue —with great effect. The floor of the office is also of stone flags, and the entire building is nearly fireproof, for there is little about it to burn.

Scattered about promiscuously throughout the building are rooms where big pieces of wood are cut down into staves, shaped and smoothed, and put together into barrels and casks. In other rooms strong packing-boxes are made for exporting the cigarettes. After a brief tour through the place the first impression is that it is a vast barrel factory and printing-office, and that a lot of cigarettes are made incidentally to fill up the barrels. One of the largest rooms on the second story, with a brick floor, like all the other upper rooms, is the printing-office. This is as well fitted and provided with types and machinery as the average New York printing-office, if there is such a thing as an average printing-office. The name that figures most prominently in the press-room is R. Hoe & Co. The type is from Bruce's foundry. Nearly every thing in use is American, except the engine that drives the machinery, and that came from Paris. They can turn out fine cigarettes, these copper-colored smokers, that sell well, and induce many imitators; but they have to call upon New York when they want to print their labels, and the paper for the labels is imported from the United States. Even the machines in which the cigarettes are rolled are from America, and nearly all the tools in use. But because this is a nest of American exportations it must not be supposed that such is generally the case throughout the city. There are very few American goods here.

The cigarette machines are simple enough. There is a reservoir filled with tobacco, like the fountain of a printing-press; the operator puts in a piece of paper, and it comes out a cigarette. There is such a heavy rotary movement, and every thing is so rounded off, that I think if a tenpenny nail should be dropped in it would come out a lead-pencil. There are 15 or 20 of these machines, and they make many thousands of cigarettes every day, but fully as many more are made by hand inside and outside of the factory. In one of the rooms on the ground floor 40 or 50 boys are at work, some rolling cigarettes, others counting them rapidly into bundles, and still others putting the papers around them with great dexterity. These boys are bright and cheerful, and seem comfortable enough; but it is not a pleasant idea to contemplate that they are slaves, and have their tasks to perform. There are still a large number of slaves in Cuba, those in Havana being owned principally by wealthy old families, who send them out by the day, like horses from a livery stable. The recollection of the old flag goes up several per cent, when it is remembered that, could one of these boys make his way to the neighboring coast of Florida, he would thenceforth be free. The number of people outside the factory who make cigarettes

JACKSON'S IMPROVEMENTS IN PATTERN-MAKING, ETC. FIG 7.

is enormous. Every one of the big houses has its porter at the door, and each porter has a brood of children about his heels. It is the perquisite of these porters to be allowed to utilize their unemployed time in making cigarettes, and as their time is pretty much all otherwise unemployed they make a great many cigarettes. Their children are taught the business as soon as they are knee-high, and the male members of the porter's family sit in the big doors, around a little stand, and make cigarettes unceasingly. The cigarette business, in the porter's mind, is of much greater importance than any business connected with his employer, and the visitor has to wait till the little cigar on the stocks has been launched. A small circle of tin is worn on the forefinger of the right hand, sharpened to a point like a huge pen, and with this the ends are neatly tucked in after the rolling is done. A light yellow paper is in great demand by smokers, and the yellow cigarettes are seen everywhere. It is thought that this paper is less hurtful to the lungs than the white. Gentlemen have constantly a roll of the cigarettes in their pockets, and the laborers are hardly ever seen without one in their mouth, and another, rolled ready for use, behind one of their ears. Ask one of the natives about the ladies' smoking, and he will tell you that cigarettes are used only by the lower classes of women; but this is a little Spanish prevarication. A native woman who does not smoke, whether she be of high or low degree, is a rare exception. The better classes of women do not often smoke in public places, while the lower classes do; but the former may be seen smoking often enough to settle any doubts on the matter. The cigarettes smoked by the ladies are made especially for them, a trifle smaller than the others, and are sent out of the factory all ready for smoking, without any additional rolling.

There is a constant stream (and it might be said a rather muddy and dirty stream) of small boys pouring into the Honradez factory, carrying rolls of cigarettes that have been made in their families, and are to be paid for. These (the cigarettes, not the boys) are usually done up in circular bundles of a thousand or more, like wheels, fastened up with a strap, or sometimes with a woollen band. The best quality of cigarettes sell at retail in Havana for 3 cents a package, silver. Upon leaving the Honradez factory, the visitor is always presented with a bundle of cigarettes, on the wrapper of which is handsomely printed, in Spanish, "Compliments of Honradez Brothers, to Señor Don San Francisco de Fiddlesticks," or whatever the visitor's name is, and the visitor puts the bundle away in his very safest pocket, to be kept as a souvenir forever, or till the next time he happens to be out of cigars.

A little piece of information that I got this morning stern duty compels me to lay before the smokers of New York. It is often said that "the Havana cigars are not originally so very much better than American cigars, but they are greatly improved by the ocean voyage, the sea air giving them a pleasant flavor." When cigars are put up in Havana for exportation they are first put in the ordinary boxes, and then in a strong and almost air-tight wooden packing-case. A tin box is then soldered around the packing-case, and the package is as air-tight as a box of canned fruit. By the time the cigars reach New York they have as much sea air about them as a clam has of mountain dew. The sad truth is, there are just as bad cigars in Havana as anywhere else, and the only one I have smoked here that was better than the average of good cigars in New York I had to pay 15 cents in silver for.

* Condensed from Correspondence of the *N. Y. Times.*

Intellect in Brutes.

A LARGE number of letters have been recently published in *Nature* giving anecdotes of animals, which to their writers give indication of the power of abstract reasoning in the brute creation. This power has been denied by many able naturalists and keen observers. We shall say nothing *pro or con* on the subject, but simply select some of the most remarkable examples of the manifestation of real or apparent intellect in brutes from the letters referred to:

Mr. WM. HOGG tells of an incident he witnessed when calling on a friend. While they were sitting in the study, the French window of which communicates with a garden at the back of the house, and had a crank latch by which it could be opened on either side, a cat presented herself outside the window, pleading for admission. She continued to plead for some time, and finding no help from within she resolved to trust to her own powers. Eying the latch, which was four feet above her, she made a spring, caught hold of the crank with her fore feet, and putting her hind feet against the other half of the window as a fulcrum she pressed open the window. This she would do several times in succession. His friend informed Mr. Hogg that the cat had never been taught to do this.

Mr. J. J. Cole, of Mayland, Sutton, Surrey, writes: It has been my custom to have—not a letter-box in a door in the usual way, but the plate and flap in the bottom of a window-sash near. I had a cat which often saw a servant go to the window on hearing the flap moved by the postman, and which when shut out, used to jump on to the window-sill and rattle the flap, and when the servant was seen through the glass, jump down to be let in at the door. I knew a horse which during week-days went round and round to the left, grinding in the cellar of a snuff-maker in London. On Sundays his owner turned him out in a field at his place in the country, where the horse went

round and round all day long, unwinding himself the other way. Why?

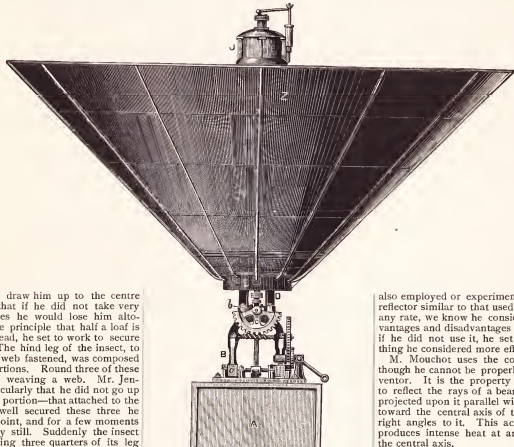
Mr. B. G. Jenkins describes a scene he witnessed between the large insect known as "daddy long-legs" and a small spider. The former got caught by one of its hind legs by a pendant thread of cobweb about eight inches long, at the other end of which was the small spider. The spider cautiously descended on the thread, doubling it as he came, and secured the insect's leg more firmly. He then ascended about three inches, and drew the insect up about half an inch; but a violent resistance on the part of the latter induced him to give up the attempt. He, however, went up the thread, strengthening it as he went, and coming down again to the same place, evidently attempted once more to raise his prey, but without success, for the insect resisted so stoutly that it appeared to me to stretch the thread. The spider, Mr. Jenkins writes, saw clearly that the insect was too strong for him, that he would never be able to draw him up to the centre of his web, and that if he did not take very summary measures he would lose him altogether; so, on the principle that half a loaf is better than no bread, he set to work to secure a portion of it. The hind leg of the insect, to which he had his web fastened, was composed of four jointed portions. Round three of these he busied himself weaving a web. Mr. Jenkins noticed particularly that he did not go up to the last jointed portion—that attached to the body. Having well secured these three he moved up to the joint, and for a few moments appeared perfectly still. Suddenly the insect darted away, leaving three quarters of its leg behind. What other explanation is there than that the spider disconnected it at the joint? Quietly ascending the thread, which he carried with him, and of course the leg as well, he properly placed the latter, settled down at the union of the two uppermost portions, gorged himself with juices from above and below, and then retired for the night.

Dr. G. Frost sends the following good story: Our servants have been accustomed during the late frost to throw the crumbs remaining from the breakfast table to the birds, and I have several times noticed that our cat used to wait there in ambush in the expectation of obtaining a hearty meal from one or two of the assembled birds. Now, so far, this circumstance in itself is not an "example of abstract reasoning." But to continue: "For the last few days this practice of feeding the birds has been left off. The cat, however, with an almost incredible amount of forethought, was observed by myself, together with two other members of the household, to scatter crumbs on the grass, with the obvious intention of enticing the birds.

Mr. A. Petrie writes: I knew a Skye terrier, who, being told to carry a fishing-rod, carefully experimented along its length, to find its centre of gravity, then carried it on till his master came to a narrow path through a wood. Here Skye considered, dropped the rod, took it by the end, and dragged it under him lengthwise, till the open road was gained, when he took the rod by the centre of gravity again, and went on. This could not be a copy of human actions, but the result of original reasoning.

Mr. A. Petrie writes: In my own family we had a tabby cat, who, when turned out, would let herself in at another door by climbing up some list nailed around it, then pushing up the click-latch, pushing the door, with herself hanging on it, *away* from the post, so as to prevent the latch falling back into its place, and then dropping down and walking back to the fire.

COMPASSES WITH NICKEL NEEDLES.—According to the *Comptes Rendus*, Mr. Jos. Whaton has sent to the Académie des Sciences a marine compass with a nickel needle. Four such compasses (constructed on a plan recommended by Sir W. Thomson) have been placed on Russian cruisers, and a fifth is to be placed on a French ship for comparison with steel needles.



MOUCHOT'S SOLAR STEAM GENERATOR.

THE GROWTH OF THE WESTERN UNION TELEGRAPH MONOPOLY is strongly deprecated in the *Operator* over the signature of SUMAC. We quote the closing paragraph of his rather caustic article:

With 206,202 miles of line already under its control, and a net annual profit of $3,551,542.70 accruing to its stockholders, some sort of an idea—a very indefinite one, for the human mind cannot grasp millions—may be formed of the stupendous proportions to which that gigantic corporation has already grown. How fare the operators who make all this possible, and what rights have they?—what benefits do they reap from this unexampled prosperity, and what public recognition is made by the company of *their* part in this rise?—are questions of some weight, or ought to be, to the operators. What W. U. operator dares to lift his shackled hand in his own defence, or even in pleading for manly fairness? What one but knows that the collar is on his neck, and the iron in his soul; that he is a thrall, property, part and parcel of the wealth of the W. U. Co.? What one but knows that his bread and butter are wrapped up in the napkin of his silence? No espionage is so lynx-eyed as that which looks along a wire: no punishment so swift as that which speeds upon the lightning's wing; no stroke so sure and deadly as the levin-bolt's descent.

Mouchot's Solar Engine.

THIS was exhibited at the Paris Exposition. It is an attempt to utilize solar heat directly in the production of motive-power. A few years since the celebrated engineer, Captain John Ericsson, made a very elaborate series of experiments in this direction, which finally, we believe, diverged into a purely scientific investigation relating to solar heat. The results of these investigations were wholly or partially embodied in numerous valuable contributions to *Nature*, and some other standard scientific publications. How far Captain Ericsson pushed his experiments in a purely practical direction we believe has not been made public, but we understood at the time that he actually constructed and put in operation a solar engine at his residence in this city. The character of the devices used by Captain Ericsson to concentrate the solar rays upon the boiler was, so far as we are aware, never fully divulged; but besides parabolic reflectors we are certain he also employed or experimented with a conical reflector similar to that used by Mouchot. At any rate, we know he considered well the advantages and disadvantages of this device, and if he did not use it, he set it aside for something he considered more efficient.

M. Mouchot uses the conical reflector, although he cannot be properly said to be its inventor. It is the property of such a reflector to reflect the rays of a beam of parallel rays projected upon it parallel with its central axis, toward the central axis of the reflector and at right angles to it. This action of the mirror produces intense heat at and in the region of the central axis.

Mouchot places a cylindrical boiler E in such manner that its central axis lies in the central axis of such a reflector Z. The surface of the boiler is blackened, and it is inclosed in a glass jacket. Luminous heat passes through glass readily, while obscure heat is obstructed in its passage by glass. The luminous heat of the sun passing through the glass and into the blackened surface of the boiler is there converted into obscure heat, and is consequently kept in by the glass jacket.

The whole is attached to machinery for bringing the central axis of the mirror into parallelism with the direction of the sun's rays, which mechanism rests upon masonry A. We shall not extend this article by a description of this mechanism, which comprises nothing novel.

The reflector and boiler might be worked by mechanism analogous to that used with large telescopes to automatically move their common axis and maintain the necessary parallelism.

A little study of this mechanism, together with a consideration of the laws which govern the conversion of water contained in vessels into steam, will disclose an important defect. When water is heated in a vessel is it important that the heat be principally applied to the lower part of the vessel. Water being practically a non-conductor of heat, and it being practically possible to heat it only by convection or the circulation of heated particles from the lower part of the mass to the upper part, it has been long a recognized principle that the intensest heat must be applied at the bottom. If this be reversed, and the

most intense heat be applied at the top, circulation is at once impeded, and in proportion as the circulation is impeded the heating of the mass is retarded.

Now, the heat concentrated upon any point of the central axis by a conical reflector is proportional to the diameter of the reflector drawn at right angles with the axis through that point. It is evident, therefore, that in Mouchot's arrangement the intensest heat must be applied to the upper part of the boiler. Were the earth the source of heat instead of the sun, and were the position of the conical mirror reversed, the conditions for effective application of heat to the water in the boiler would be established. As it is, the circulation must be very imperfect.

We do not positively know, but we suspect that Captain Ericsson saw in this difficulty one reason for employing parabolic mirrors; and it seems not to be difficult to construct a mirror with such curvature that the heat, instead of being reflected at right angles towards the entire central axis of the boiler, might be converged to the lower part.

This and other reasons that might be named prevented the attainment of very brilliant results by the Mouchot solar boiler. The steam generated was employed for pumping, through the agency of a reciprocating engine. It proved impossible to keep up steam to the required pressure, except intermittently for short periods of time under favorable circumstances.

The principle has been applied to cooking apparatus with more satisfactory results, a glass cylinder taking the place of the boiler, and serving as a receptacle for the articles to be cooked, etc. It is asserted that with a cone reflector sixteen inches in diameter and ten inches high the cooking of beef and poultry has been successfully and quite rapidly accomplished in France, and still more rapidly in Algeria.

BANANAS AS A MATERIAL FOR THE MANUFACTURE OF ALCOHOL are proposed. It is said that their great cheapness in countries where they are grown and their richness in sugar eminently fits them for this purpose, and that a profitable investment of capital would be found in the establishment of alcohol distilleries in Venezuela and other lands where this fruit is grown in abundance. Experiments in the manufacture of sugar from the fruit have proved unsuccessful. The pulp of the banana contains, according to analyses of MM. Marcano and Muntz, 8.5 per cent of cane sugar, and 6.4 per cent of grape sugar.

A PROCESS FOR CHEMICALLY BLACKENING ZINC has been devised by M. Fuscher, an outline of which is published in the last number of the Transactions of the Frankfort "Physisches Verein." The inventor first scours the zinc to be operated on with fine sand and very dilute hydrochloric acid, and then plunges it into a solution of equal parts of chlorate of potash and sulphate of copper in 36 parts of water. When withdrawn, after a short interval, it is found to have taken up a fine coating of velvety black, which, however, at this stage very readily comes off. To insure its permanency, the zinc thus coated is quickly washed with water, allowed to dry, and then plunged into a weak solution of asphalt in benzole. The excess of this fluid is allowed to drain off, and the color can then be fixed by rubbing the sheet with a cotton plug. Zinc thus blacked is found to be particularly suitable for covering in roofing.

A VERY LARGE VESSEL was lately launched by the Messrs. Elder, of Govan, Scotland. She is a screw steamer, 445 feet in length by 46 feet in breadth, tonnage 5500, with engines of 6000 horse-power. She is called the Arizona, and was built for the Guion line of Atlantic steamers.

THERE seems every likelihood that an attempt will be made to train African elephants as bearers of burdens, and an association has been formed for the opening up of African trade by this means. This is a much more sensible plan than the construction of a railway, which has been so prematurely proposed in some quarters. With the aid at first of Indian trainers we see no reason why the African elephant should not be made as useful as his Indian brother.

Edison's Motograph Receiver.

THIS is doubtless one of the most original of Mr. Edison's inventions. In it, as in the phonograph, his remarkable genius has seized upon a hitherto unknown principle which he has demonstrated as a fact, although it yet awaits an adequate explanation.

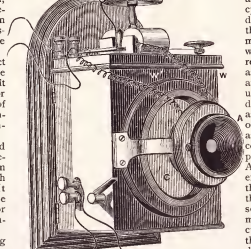


FIG. 1

Fig. 1 is a front view of the instrument; Fig. 2 a back view. It should be premised that the instrument in England has been hurriedly and roughly made, we believe, in order [that Professor Tyndall might have a model to illustrate the portion of his course of lectures on "Sound," now being delivered at the Royal Institution. Mr. Edison, in a letter to Colonel Gouraud, says: "Please understand, and have others understand, that these instruments were made in five days, and are only experimental." Unfortunately, the transmitter in these experimental instruments is placed directly in front of the receiving diaphragm, whereas it will ultimately be placed elsewhere, A being the transmitting telephone, C the receiving diaphragm. On the top of the iron box containing the apparatus is placed a call bell, so that any who wishes to transmit a message can indicate his wish. Fig. 2 shows fully the parts of the instrument. F F is an iron casting, into which one end of the spring S is fixed. This spring is regulated by the binding screw B. The brass axis C is connected with the wheel W, which is driven by W', the latter being actuated by the recipient of the message by the handle H, or preferably by an automatic apparatus. Upon C is placed a chemically-prepared chalk cylinder K. As the axis C rotates, so does this cylinder. Connected with the centre of the mica diaphragm at D is a metal rod R, one end of which rests on the rotating cylinder, the requisite pressure being obtained by adjusting the spring S. The contact between the cylinder and the rod gives rise to friction, and as the cylinder is rotated in a direction away from the diaphragm, the diaphragm is pulled because of this friction. So far the operation is purely mechanical, and, were the axis moved by clockwork, a point would almost immediately be reached when the resistance of the diaphragm and the friction would be equal, and so long after this as the motion of the cylinder is uniform no alteration in the position of the diaphragm will take place. When, however, an electrical current passes through the circuit, of which the cylinder and metal rod form part, an electro-chemical action takes place, the coefficient of friction is lessened and the diaphragm moves towards its normal position. As soon, however, as the current ceases, the full effect of friction is felt upon the diaphragm. If the strength of the current vary, it is said that the friction varies proportionally, and as the sound waves impinge upon the transmitting membrane with a constantly varying force, the current transmitted constantly varies; hence the friction varies, and lastly the motion of the diaphragm of the receiver. It will probably be found that this is not an exact description of the action of the instrument, but that there is an absolute cessation of current, and that the action of the diaphragm is due to this cessation of current, and not to variation of the current. Be this as it may, the current is governed by the sound waves, and hence the motion of the receiving diaphragm is so governed also, and thus the sound waves are reproduced by the receiving instrument.

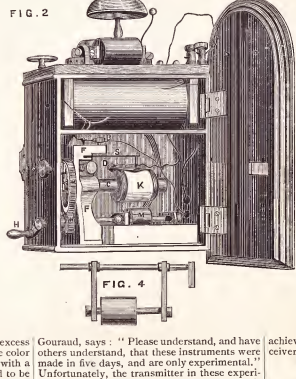


FIG. 2

FIG. 4

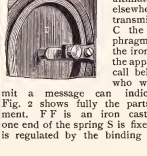


FIG. 3

Referring again to Fig. 2, M is an axle carrying the roller R, which dips into a vessel containing some water. The roller R is raised by means of a lever, and brought into contact with the chalk cylinder, which is thus kept well moistened.

The *Engineer*, from which we have reproduced our engravings and condensed the description of the instrument, is of the opinion that an improvement upon the moistening roller would be the introduction of a capillary arrangement so adjusted that the requisite moisture would be supplied.

Fig. 3 shows the receiving diaphragm with its adjusting screw and spring. Fig. 4 shows the mechanism of the roller M.

Engineering, another English contemporary, speaks in glowing terms of this invention and its superiority to Bell's telephone, the manufacturers of which have invited competition by the burdensome and extravagant royalties exacted of users of their instruments. The defect of Bell's instrument has been the feebleness of the sound transmitted. So far from being saddled with this defect is Mr. Edison's motograph, that the journal quoted says it may be properly called the shouting telephone. It also adds that as Edison has unquestionably produced the best transmitter of sound, he now has achieved the honor of producing the best receiver.

Good for the Nursery.

THE senior editor of the SCIENTIFIC NEWS, having for the first time in his life risen to the dignity of grandfather, the fact became known to Mrs. Amelia A. Heaton, of Bingham, N. Y., who, actuated by a benevolent intention to do something to mitigate the usual discomforts peculiar to the nursery, has sent to us a set of her patent nursery clothes-bars, illustrated in No. 1 of this volume. The apparatus is in active operation, and it is a very pretty sight indeed to see the small clothes of the baby spread around over this most ingenious and convenient piece of mechanism. Every mother ought to have on hand one or more of Mrs. Heaton's nursery clothes-bars.

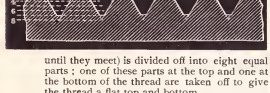
A NEW METHOD OF DETERMINING THE FUSING POINTS OF FATTY BODIES has been devised by M. A. Terreil, which, in certain respects, possesses considerable advantages over the general method. Instead of putting the substance into a tube connected with the reservoir he places it directly upon the latter, first partially melting some of it, and then by means of a slender rod, slightly warmed, depositing one single drop on the desired point. The bulb of the thermometer is then exposed to the heat of a gas jet at such a distance from it that the temperature rises only very slowly. At the moment of melting the temperature is read off, and the bulb then allowed to cool down slowly till the point of solidification is reached, when the state of the mercury is again noted. The process of alternately warming and cooling is repeated several times, so as to verify the indications first obtained. M. Terreil claims for his modification the advantages of being simple and rapid of execution, and also of permitting observations on substances whose melting point is above 100° C., besides which the extreme smallness of the quantity under treatment prevents the productionof the phenomena of surfusion.

Screw Threads.

BY JOSHUA ROSE, M.E.

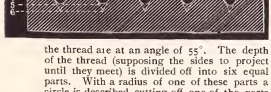
THE forms of screw thread in use for ironwork are shown in Figs. 1, 2, 3, 4, and 5. Fig. 1 represents the United States standard or Franklin Institute thread. It was designed by Mr. William Sellers, of Philadelphia, to overcome the difficulties attending the origination of threads having a round top and bottom.

Its form is shown in Fig. 1. The sides of the thread are at an angle of 60°. The depth of the thread (supposing the sides to project



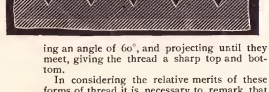
until they meet) is divided off into eight equal parts; one of these parts at the top and one at the bottom of the thread are taken off to give the thread a flat top and bottom.

The form of the Whitworth, or English standard thread, is as in Fig. 2. The sides of



the thread are at an angle of 55°. The depth of the thread (supposing the sides to project until they meet) is divided off into six equal parts. With a radius of one of these parts a circle is described cutting off one of the parts at the top and at the bottom of the thread (as shown by the small dotted circles in the cut), and giving the thread a round top and bottom.

The proportions of the sharp V-thread are as shown in Fig. 3, the sides of the thread form-



ing an angle of 60°, and projecting until they meet, giving the thread a sharp top and bottom.

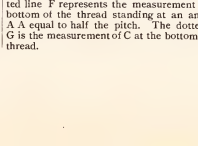
In considering the relative merits of these forms of thread it is necessary to remark that the dies used to cut threads in bolt-cutting nut-tapping machines, etc., are threaded in nearly all cases* by taps or hobs which are originated in the lathe; hence the accuracy of the threads depends upon the accuracy of the lathe screw cutting.

The single advantage possessed by the sharp V-thread is that the tool for cutting it in the lathe can be more easily made and sharpened than can that for either of the others. But, on the other hand, it weakens the bolt by reason of the sharp nick formed by the bottom of the thread. Furthermore, the top of the thread is apt to become a feather edge, which rises slightly above the diameter of the work; hence, to measure correctly the diameter of the thread, it becomes necessary to remove this edge (which is done with a dead smooth file, the lathe running at a quick speed).

Now suppose the diameter of the blank work to be made correct to gauge, cutting the thread upon it is apt to raise the fine edge at the top of the thread above the standard diameter, and in removing the raised edge the gauge must again be employed, or too much metal may be removed and the tops of the thread reduced below the proper diameter.

To avoid this extra labor and source of error it is a common workshop practice to measure sharp V-threads at the bottom or root of the thread, using for the purpose a pair of very thin pointed calipers. In this case it is necessary to have a threaded gauge of the same diameter and having the same pitch of thread as the work, whereas with a flat top and bottom, or with a round top and bottom thread, the diameter of the blank work serves as a standard of size. In Fig. 4, for example, is shown a flat

top and bottom thread, the blank being turned to standard size, and the thread being cut by the tool until the gauge A fits the thread and at the same time meets the tops of the thread, as shown. By the employment of this gauge the thread may be cut to its proper depth irrespective of the diameter of the work. When the diameter of a thread is measured at the bottom or root of the thread the latter becomes the standard of size. This possesses several serious disadvantages. First, the calipers applied to the bottom of the thread do not stand at a right angle to the axis of the bolt on which the thread is cut, but at an angle equal to the pitch of the thread, as shown in Fig. 5.



Now the same pitch of thread is necessarily used in mechanical manipulation upon work (except in the case of bolts and nuts) of widely varying diameters, and as the angle of the calipers upon the same pitch of thread would vary (decreasing as the diameter of the thread increases), the diameter measured at the bottom of the thread would bear a constantly varying proportion to the diameter measured across the tops of the thread. Thus in Fig. 5 A A is the axial line of two threaded pieces. B, C, D, D, represents a gauge applied to B, its width covering the tops of two threads and measuring the diameter at a right angle to A A, as denoted by the dotted line E. The dotted line F represents the measurement at the bottom of the thread standing at an angle to A A equal to half the pitch. The dotted line G is the measurement of C at the bottom of the thread.

Now suppose the diameter of B to be 1½ inches at the top of the thread, and 1¼ inches at the bottom, while C is 1⅛ inches on the top and ⅞ at the bottom of the thread, the pitches of the two threads being ¼ inch; then the angle of F to A A will be ¼ inch (half the pitch) in 1¼. The angle of G to A A will be ⅛ inch (half the pitch) in ⅞ (the diameter at the bottom or root of the thread).

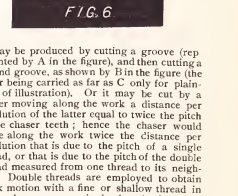
It is obvious, then, that it is impracticable to gauge threads from their diameters at the bottom, or root, as it is sometimes called.

The objections to the round top and bottom thread are that it requires to be cut by a tool having more than one tooth, being usually cut by a chaser or tool having six or seven teeth in the case of fine threads, and at least two or three threads if the pitch is coarse. To obtain these chasers a standard master tap or hob is necessary wherewith to cut the thread upon the chaser, the operation being a slow one. The broad cutting edge of a chaser causes it to spring or deflect and to follow the texture of the metal, dipping into the softer and springing away from the harder parts or places in the metal.

Again, suppose the hob to be cut true in the lathe, and its thread to be of correct pitch. The hardening process will alter the pitch, causing it in a majority of cases to become finer, and in exceptional cases to get coarser. Then when the chaser (after being cut by the hob) is hardened, a second alteration of pitch usually takes place, inducing an error which on this form of thread we have at present no means of eliminating.

The United States standard thread is entirely free from this objection, inasmuch as it can be originated with a common single toothed turning tool, ground, *after being hardened*, to the proper angle, and with the necessary flat place at the point. Hence the error incident to hardening the screw-cutting tool is here entirely eliminated.

A double thread consists of two threads, one intermediate to the other, as shown in Fig. 6.

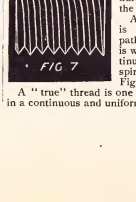


It may be produced by cutting a groove (represented by A in the figure), and then cutting a second groove, as shown by B in the figure (the latter being carried as far as C only for plainness of illustration). Or it may be cut by a chaser moving along the work a distance per revolution of the latter equal to twice the pitch of the chaser teeth; hence the chaser would move along the work twice the distance per revolution that is due to the pitch of a single thread, or that is due to the pitch of the double thread measured from one thread to its neighbor. Double threads are employed to obtain quick motion with a fine or shallow thread in cases when a coarse single thread of a sufficiently coarse pitch would unduly weaken the parts containing the thread.

In like manner treble and quadruple threads are sometimes made.

The term "diameter" of a thread implies the diameter of the tops of the thread measured at a right angle to the axis of the work.

The depth of a thread means the vertical height (or vertical depth) of the thread measured



from the top to the bottom of the thread. The pitch of a thread is the distance the thread advances along the work during one rotation of the latter.

A "drunken" thread is one in which its path around the work is waved and not a continuous and uniform spiral, as shown in Fig. 7.

A "true" thread is one which does advance in a continuous and uniform spiral.

* The Morse Twist Drill and Machine Co. cut their threads in specially designed milling machines.

The Mutual Relations of Capital and Labor.

A PAPER READ AT THE CHURCH CONGRESS IN CINCINNATI, OCTOBER 18, 1878, BY HON. ABRAM S. HEWITT.

No. II.

LABOR AND WAGES.

THE difficulties of the situation are, however, enormously increased by the fact of the comparatively recent enfranchisement of so large a portion of the human race. They have achieved liberty, but they have not inherited property, which is the fruit of liberty. The principles upon which they are to receive their share of the results of human effort have not only not been defined, but they have only begun to receive attention. Until the modern development of industry the compensation of labor had but little reference to what the labor might produce. The slave, the serf, the bondsman, was fed and clothed, and when freed he inherited the custom of being fed and clothed. Hence what may be termed the custom of wages was based upon what the laborer required to keep him in a condition for efficient labor. Any thing beyond this limit he could get only from the conscience of his employer, or by the force of his own will. The power of isolated men to resist and overcome the force of custom is very slight. No radical, or even appreciable, change can be effected, except by a union among those who believe themselves aggrieved. In other words, the principle of association must be invoked in order to produce any marked departure from prevailing practice.

THE CONFLICT.

Given, then, a state of things in which the wealth was in the hands of one class, who necessarily became the employers of labor instead of being its owners; and the muscular power in the possession of another class, possessing nothing besides muscle, and who, out of the common results of the employment of capital and labor, obtained only a bare subsistence, notwithstanding it was apparent that there was a steady increase in the amount of wealth, which, instead of being equitably distributed, was all appropriated by the employing class—it was inevitable, as it was just, that a struggle should arise to enforce a different ratio of distribution. What is known as the conflict between capital and labor has thus a natural origin, and so far from being a subject of regret, it is to be welcomed as evidence of a healthy and growing vital force in the organization of society. It is an effort to correct an abuse; for, however ready we may be to admit that there must be inequality in the distribution of property proportioned to the contribution of each individual to its accumulation, no one has ever pretended that the entire surplus should go to one class, at the expense and to the deprivation of another class. I know that natural laws are relied upon by the economists to effect this distribution, and I am not prepared to say that these natural laws might not assert themselves by some other methods from those which we find adopted by the contending forces of society. My purpose is rather to show the way in which the problem is being solved, and to insist upon it that this particular way is not to be resisted and objected to because the abstract thinkers of the world would prefer some other method.

STRIKES AND LOCKOUTS.

What is the method of solution which we find in process of execution? The working classes think they do not receive their fair share of the proceeds of productive industry. As individuals they ask for more. The demand is refused. They combine; they call themselves a "trades-union." As a union they ask for more. The demand is again refused. They decline to continue to labor; in other words, they strike. Capital ceases to earn profit, and labor ceases to earn wages. Capital can feed upon itself for a time. Labor cannot. The strike fails, and labor has made no progress in obtaining what it believes to be its just rights. Labor takes a lesson from capital. It saves money from its scanty earnings as a reserve fund to sustain itself while in a condition of strike. Then, when sufficiently strong, it repeats the experiment. Sometimes it is successful, and sometimes it is not. The reserve is generally exhausted before success is achieved, and labor falls back, sullen, defeated, but resolute. The lesson of association is not lost. The unions in different trades combine and make common cause with each other, and when one union goes into a strike the others assist. Thus they become a great power, and capital at length comprehends that profit can no longer be realized except by the consent of labor, and labor comprehends that while it can deprive capital of profit it can only do so through an amount of personal suffering which tries the human heart to its utmost capacity, because it addresses itself to that love which is the foundation of the human family, and is a coordinating element in the constitution of society. Up to this point the progress has only been attended with evil, just as the progress of mankind towards free government and towards the enfranchisement of men was by a pathway strewn with the wrecks of human hopes and marked by sacrifices and calamities which no pen can describe. But one good result has been achieved. Labor is thoroughly organized and marshalled on the one side, while capital is combined on the other, each powerful to destroy the other if they engage in conflict, but equally powerful to assist each other if they work together in harmony. The contending forces are thus in a condition to treat. The great result achieved is that capital is ready to discuss. It is not to be disguised that until labor presented itself in such an attitude as to compel a hearing capital was not willing to listen, but now it does listen. The results already attained are full of encouragement; the way to a condition of permanent peace appears to have been opened.

CONCILIATION AND ARBITRATION.

The first step was taken about fifteen years ago, when the principle of conciliation was successfully adopted at Nottingham. Conciliation necessarily led to arbitration, and as the direct result of conciliation and arbitration the necessity for strikes has been very largely diminished, so that it may now be affirmed that while strikes still take place, they are the exception and not the rule. Let it not be supposed, however, that conciliation and arbitration are other than transitional means for bringing about the ultimate relations of peace and harmony which must exist between capital and labor before the vast evils which accompany modern industry can be eliminated or materially circumscribed.

Before attempting to point out the road which the law of Christian progress seems to be taking in this direction, I desire to reinforce what I have already said in regard to the power of trades-unions, singly and in combination, by a few figures. The strongest of the trades-unions in England is the Amalgamated Society of Engineers. They were organized in 1851. They have passed through many strikes. Sometimes they have failed and sometimes they have succeeded. They began with an accumulated fund of £1,700. The growth of this fund has varied, as a matter of course, with the demands which have been made upon it to sustain the members of the union during a strike; but the practical result is that in 1876 the fund in hand amounted to over £275,000, and the number of members, which began with 11,617, had risen to 44,578. The Society of Boiler Makers and Shipbuilders in 1876 had also accumulated a fund of £45,000. The Society of Carpenters and Joiners in sixteen years have accumulated a fund of £74,000. At the General Trades-Union Congress, held at Leicester in 1877, 112 of these unions were represented, with a membership of 691,089 persons.

These figures make it apparent that a new power has entered into the industrial world which must be recognized. It is also apparent that this power cannot be destroyed by force or violence unless society be destroyed with it. It must be heard. Its just demands must be heeded. This is the voice of reason as well as of religion.

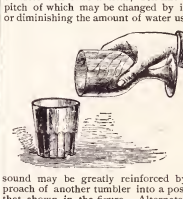
MAGNETS FOR REMOVING FRAGMENTS OF WIRE FROM GRAIN.—In harvesting has been found by the self-binding harvesters now in use in the wheat-growing regions of the West, have proved so successful that the opposition to the use of wire-binding machines on the part of millers is likely to cease. The application is extremely simple and ought to have suggested itself to any person familiar with the use of magnets for removing iron filings from brass scrap. A series of horseshoe magnets are arranged in a spout through which the wheat passes. The magnets attract and retain all the fragments of iron that may be in the grain.

Simple Scientific Experiments.

VORTEX RINGS.—The reader may readily make such rings and trace their characteristic motion by means of smoke. Take a small tin can or box, punch a round hole in the bottom. Tie over the other end, from which the cover has been removed, a sheet of writing paper like a drum-head. Roll up a bit of paper after the

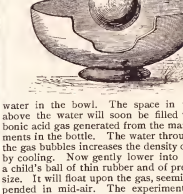
manner of a cigar-lighter; light the rolled paper, let it get well ablaze, then blow it out and thrust the smoking end through the hole. This will soon fill the interior with smoke. Tapping on the paper will now produce the rings. The phenomenon of these rings is very interesting, and at present engages much of the attention of scientific men.

AUGMENTATION OF SOUND BY PROXIMITY OF RESONANT CAVITIES.—Place a tumbler on a table and put therein a small quantity of water. When struck lightly with any hard object the tumbler will emit a clear, bell-like tone, the pitch of which may be changed by increasing or diminishing the amount of water used. This



sound may be greatly reinforced by the approach of another tumbler into a position like that shown in the figure. Alternate swelling or diminishing of the sound may be produced by moving the tumbler or goblet held in the hand from right to left. The change in volume is caused by the alternate approach and recession of the resonant cavity.

EXPERIMENT ILLUSTRATING THE WEIGHT OF CARBONIC ACID.—Place a small quantity of water in a rather deep bowl. Put in a bottle some fragments of marble, and fit in the mouth of the bottle a cork through which has been inserted a short piece of glass tubing or a fragment of a tobacco-pipe stem. Slip on the tube a half yard or so of flexible tubing. Pour into the bottle some dilute sulphuric acid, insert the cork, not too tightly, and hold the free end of the rubber tubing under the surface of the



water in the bowl. The space in the bowl above the water will soon be filled with carbonic acid gas generated from the marble fragments in the bottle. The water through which the gas bubbles increases the density of the gas by cooling. Now gently lower into the bowl a child's ball of thin rubber and of pretty large size. It will float upon the gas, seemingly suspended in mid-air. The experiment may be varied by substituting a deep glass jar for the bowl, filling it with the gas, and then dropping in the ball from a little height. The ball will then descend a little way into the jar and rise again, precisely as a piece of timber lighter than water will do when plunged in a pond.

CHLORIDE OF METHYL, or methylchlorhydric ether, discovered in 1840 by Dumas and Peligot, is now economically produced on a large scale at the beetroot distilleries of Tilloy, Delaune, & Co., at Courieres and Brigonnet, at St. Denis, it having been ascertained by M. Camille Vincent, the directing engineer of the former establishment, that by submitting the residue of beetroot molasses to dry distillation there is obtained, amongst other products hitherto lost, an abundant quantity of ammonia and methylic alcohol, also a notable quantity of trimethylamine, etc., from which chloride of methyl, in the gaseous state, can, by a simple operation, be produced. This gas, after being thoroughly dried, is condensed by pressure at the ordinary temperature, and stored in thick metallic reservoirs. In this state it is a colorless, very mobile fluid, having a sweet, ethereal odor. It boils at about — 23° C., under normal pressure.

At 0° the total tension of its vapour is	2·48	atmospheres.
15°	"	"	4·11	"
20°	"	"	4·81	"
25°	"	"	5·58	"
30°	"	"	6·05	"

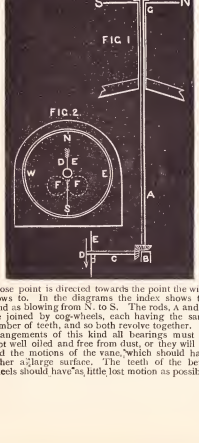
It is conveyed in cylinders of copper or steel, containing from 2 to 200 kilos. Amongst the important uses to which this liquid can be applied is the production of intense cold.

Of still more importance is its use in the preparation of artificial colors derived from coaltar, this new industry procuring in abundance, and at a low price, a material much in demand by color manufacturers. The methylamine violet, the Hofmann violet, methylamine green, methyl-diphenylamine, methylated rosine, and other coloring matters in which methyl plays any part will find in chloride of methyl a source which will advantageously replace the methylic compounds now employed, such as the bromide, iodide, and nitrate of methyl; such advantages being both hygienic and economical, and will avoid the dangers of explosion arising from the employment of nitrate of methyl.

M. Vincent has rendered a real service to the chemical arts, and has been awarded a gold medal by the Société d'Encouragement pour l'Industrie Nationale.

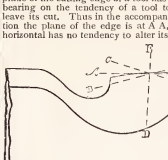
Shop and House Hints.

Wind Indicator.—Any of our readers wishing to construct one of these useful meteorological instruments may easily do so, guiding himself by the diagram and description: A is the spindle, carrying the vane, and moves freely on well-lubricated bearings or rollers at G, and a fine point on the block, B. The axis, C, turns on a spindle point at B, and on friction wheels, in passing through the dial-plate, E, where it terminates in the hand, D,



whose point is directed towards the point the wind blows to. In the diagrams the index shows the wind as blowing from N. to S. The rods, A and C, are joined by cog-wheels, each having the same number of teeth, and so both revolve together. In arrangements of this kind all bearings must be kept well oiled and free from dust, or they will retard the motions of the vane, which should have rather a large surface. The teeth of the bevel wheels should have as little lost motion as possible.

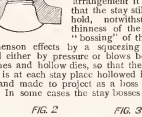
Iron-Cutting Tools.—The direction of the plane of the cutting edge of a tool has an important bearing on the tendency of a tool to increase or leave its cut. Thus in the accompanying illustration the plane of the edge is at A A, which being horizontal has no tendency to alter its depth of cut.



Were the plane at C C, the cut would exert a strain tending to force the tool away: while were it at B B, the strain would be in a direction to force the tool deeper into its cut, the angle of the top face being on the plane E D at a right angle to the bottom F of the tool.

Locomotive Firebox Stays.—This invention is due to Mr. J. F. Stephenson of the North Eastern Railway, England. The leading feature of the plan is the "bossing" or thickening of the firebox plates at the points where they are tapped to receive the stays. The arrangement is shown by Fig. 1, while Figs. 2 and 3 afford a comparison of a plate thus stayed and an ordinary firebox plate when the thickness is reduced by wear or corrosion. In Mr. Stephenson's arrangement it will be seen that the stay still has a good hold, notwithstanding the thinness of the plate. The "bossing" of the plates Mr. Stephenson effects by a squeezing action produced either by pressure or blows between blunt punches and hollow dies, so that the metal of the plate is at each stay place hollowed in on the one side and made to project as a boss on the other side. In some cases the stay bosses produced as

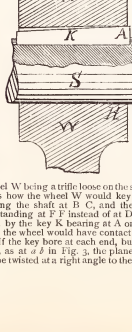
FIG. 1



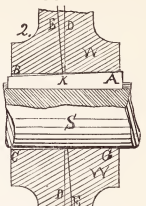
above described are subjected to a further squeezing action between punches and dies, so as to thin the middle of the boss and swell it out laterally. The embossing may also obviously be effected by passing the plates between rollers having suitable hollows and projections.

To Test Guano, it is recommended to hold one ounce in an iron spoon over a fire till it burns to a white ash; if the guano is unadulterated, the ash should not weigh more than a quarter of an ounce.

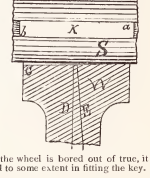
Keying Wheels to Shafts.—To fit a key properly it must be driven in while trying it very lightly, otherwise, from the elasticity of the metal, the bearing marks will show the key to be a better fit than it actually is, and to whatever play there is between the wheel bore and the shaft, added to the elasticity, the wheel will be keyed out of true. Fig. 1 shows a key K, having bearing at its end A only,



the wheel W being a trifle loose on the shaft S. Fig. 2 shows how the wheel W would key up, the bore not fitting the shaft at B C, and the plane of the wheel standing at F F instead of at D D, which is induced by the key K bearing at A only, while the bore of the wheel would have contact at the end C only. If the key bore at each end, but on opposite corners, as at *a b* in Fig. 3, the plane of the wheel would be twisted at a right angle to the length of the key K, the plane of the wheel standing at E E instead of at D D, Fig. 3, while the wheel and shaft



would have contact at C C only. If the key is bedded to bear all over, it will not spring the wheel;



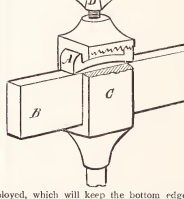
while if the wheel is bored out of true, it may be remedied to some extent in fitting the key.

Make-Shift with Brad-Awl.—A few days ago I had a large number of holes to make with a brad-awl, and I found the labor quite hard until I thought of a better plan. I split the wood off my awl-handle, and had left a little chuck which would hold the awl firmly and itself go into my bit-brace. When I have occasion, I presume I can put in a very small drill and put the whole in the drill-chuck of my lathe.

Yours truly, H. A. Sprague.

Some queries from this correspondent will be answered in our next.—ED.

Setting Trammels.—To keep trammels from shifting their position when fastening them (with the thumb-screw D, in the figure, to the staff B), the piece A, which is spring tempered, should be em-



ployed, which will keep the bottom edge of the sliding piece C fair with and close against B, so that the point will not move when either tightening or loosening D.

Effect of Steam Heat on Canvas.—P. C. A. wishes to know the temperature of exhaust steam, the initial pressure in cylinder being 90 lbs. He gives dimensions of boiler and cylinder, but these data are not essential. He omits to say whether the steam follows the piston during full stroke, or, if cut off at any point of the stroke, at what point the cut-off is made. This would be essential to determination of the temperature of the steam at end of stroke just previous to exhaust. But as the drift of his queries appears to be to ascertain whether the exhaust steam would be hot enough to scorch canvas in contact with the escape-pipe, on the outside, we can answer on this point that the steam, even if the full 90 lbs. were maintained throughout the stroke, will, when exhausted into an escape-pipe large enough to prevent any

back pressure, immediately expand to atmospheric pressure at which its temperature is 212° F. only, a perfectly safe temperature which will not scorch canvas in contact with the pipe, although when the action is long continued it will hasten more or less an incipient decomposition, the canvas assuming a state commonly described as rotten.

List of Patents Granted March 25th and April 1st, 1879.

We will supply copies of any of the patents in this list, post-paid, to any address in the United States or Canada, on receipt of 50 cents per copy.

Patents granted on the 25th day of March, 1879.

Agricultural engine, G. Kratz	213,511
Air-tight vessels, detachable cover for, F. C. Prindle	213,688
Alarm and door-knob combined F. N. Cottle	213,547
Annunciators, circuit-closer for electric, C. C. Egerton and H. M. Green	213,500
Apple-mill and cider-press, P. McClanahan	213,672
Aspirator, concealed uterine cauterizer, and vaginal syringe, combined, A. L. Palmer	213,588
Ax, W. H. Fix	213,646
Axle-box lid, car, J. Seath	213,696
Axle, car, H. Watkeys	213,597
Bail for hollow-ware, J. Murdock	213,524
Balloon, aerial, A. Apraxine	213,603
Barrels, handling, R. S. Clark and J. R. Wilhelm.	213,545
Bed-bottom, J. C. Gordon	213,561
Bedstead, invalid, P. K. Stice and W. H. King	213,706
Blacking stool, boot, W. W. Shipman	213,533
Bleaching-keir, T. Fletcher	213,647
Boiler-heads, machine for flanging, R. C. Nugent.	213,585
Boot and shoe, G. Apfel	213,490
Boot and shoe, G. Champomier	213,619
Boot and shoe last, G. D. Paul	213,528
Bottle for holding compressed gases, and case, W. A. and W. F. Johnston	213,576
Bottle-washer, O. A. Miles and E. R. Lovett	213,583
Bottles, marking, R. M. Atwater	213,606
Broiler, A. C. Selleck	213,532
Burglar-alarm, J. D. William	213,728
Butter, preparing and packing, J. Higgins	213,568
Can-opener, T. F. Wilson	213,723
Candlestick, A. J. Smith	213,701
Car brake, railway, P. L. V. Véron and E. Edeline	213,714
Carriage-top, J. E. Lines	213,513
Carriages, parasol for children's, J. M. Doubleday.	213,552
Cement for uniting leather, wood, etc., W. R. Hicks	213,567
Climbing apparatus, E. Von Mengden	213,715
Cock, gauge, J. B. Léger	213,669
Cockle-separator, A. Wemple	213,720
Coffee-mill, O. W. Stow	213,707
Coffins, bending lumber for, L. W. Drake	213,636
Coloring-matter, J. P. Griess.	213,563
Coloring-matter, J. P. Griess	213,564
Coulter, plough, J. Clayton	213,622
Corn-sheller, hand, G. W. Grimes	213,651
Cultivator, carriage, T. Meikle	213,675
Cut-off, steam-engine, A. A. Stewart	213,534
Dash-board, J. E. Lines	213,514
Dental-engine hand-piece, W. A. Johnston and A. W. Browne	213,662
Desk or settee, school, J. K. Otis	213,587
Desk, school, J. B. Sherwood	213,593
Diaphragm-meter, W. B. Mountency.	213,680
Door-holder, R. H. Barnard	213,611
Drying-kiln, C. W. Boynton.	213,542
Egg-tester, D. W. Pomeroy	213,687
Electric light, M. G. Farmer	213,643
Elevating and conveying, movement for, G. Sanford	213,695
Elevators, device for stopping the motion of, H. A. Guild	213,565
Envelope-case. C. H. Norris	213,681
Fan, fly, B. J. Feldman and T. Schlag	213,644
Fare-register, W. H. Hornum	213,657
Faucet and tap attachment, E. Kronenberg and C. Diehl	213,667
Fence, W. R. White	213,599
Fence-post, L. C. Grant	213,506
Fire-alarm, automatic, P. H. Van Der Weyde	213,536
Fire-arm, J. Bowles	213,616
Fire-arm, magazine. G. F. Evans	213,555
Fire-arm, magazine, W. W. Wetmore	213,538
Fire-escape ladder, C. C. Chamberlain	213,544
Flour-mill separator, I. Morgan	213,678
Flower and work stand, T. Murgatroyd	213,523
Fluting-machine, J. E. Wilson	213,724
Folding chair, H. B. Smith	213,700
Fruit-jar wrench, D. Sherwood and G. D. Dudley.	213,698
Gas-engine, W. Wittig and W. Hees	213,539
Gas generator and carbureter, hydrogen, J. F. Williams	213,600
Glass for ornamentation, grinding, J. Story	213,594
Glassware, machine for shaping and finishing, T. B. Atterbury and W. Beck.	213,605
Grain, device for removing metallic substances from, A. McKain	213,519
Grain-door, G. C. Banta	213,491
Grain-elevator, pneumatic, F. Taggart	213,709
Grain, machine for separating magnetic substances from, C. Wheeler, Jr.	213,598
Grain-meter, A Gleason	213,560
Grate, W. McClave	213,516
Grindstone tool-holder, M. S. Curtiss	213 496
Hair, treatment of, J. Bené (reissue)	8,637
Harrow, O. Bayles.	213,541
Harvester, S. C. Cobb	213,494
Harvester, J. F. Seiberling (reissue)	8,641
Harvester finger-bar, W. H. Davis	213,497
Hat-stiffening machine, G. Yule and W. W. Stone	213,727
Hay elevator and carrier, G. H. Fowler	213,559
Hay-fork, horse, J. R. Fitzhugh	213,645
Hobby-horse, I. A. Stowe	213,708
Hoe, scuffle, T. V. Munson	213,584
Hog-ringing implement, J. H. Brown	213,618
Honey-comb frame, C. Eggelston and T. W. Reed	213,638
Hoof-expander, C. H. Shepard	213,592
Horse-detaching apparatus, G. P. Jewett	213,574
Hose-coupling, J. W. Kennedy	213,577
Hot-air furnace, D. Milson	213,676
Hubs, method of and apparatus for drying, J. Urmston (reissue)	8,633
Ice-making apparatus, C. B. Lee	213,668
Injector, A. Friedmann	213,648
Insect trap for protecting fruit, etc., R. H. Wells.	213,719
Joint, valve, and trap protector for underground pipes, accessible, A. Harvey	213,653
Key-fastener, A. E. Peck	213,590
Lamp, P. J. Clark and J. Kintz	213,620
Lantern, P. V. Coogan	213,627
Lantern, A. H. Greene	213,650
Lantern, J. W. Orphy	213,682
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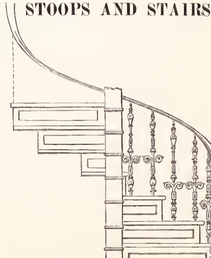

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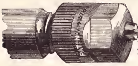

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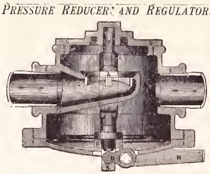

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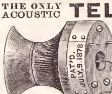

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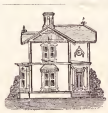

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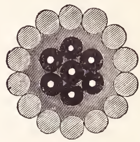

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